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The SharkRF openSPOT 70cm DMR/D-STAR/ Fusion Hotspot

Tim Kirby G4VXE takes a look at the SharkRF openSPOT, a really handy piece of kit if you are into VHF digital voice modes.

When the first advertising and mention of the SharkRF openSPOT appeared, I was very interested. As well as doing what other digital radio 'hotspots' do, it had some intriguing other possibilities that appealed to me. I was delighted when *PW* advertiser Martin Lynch & Sons very kindly offered a unit for review.

What is a Digital Radio Hotspot?

So, what are we talking about? A digital radio hotspot is a small transceiver (for 70cm, in the case of the openSPOT) capable of one or more digital modes such as DMR, D-STAR or Fusion (C4FM) that works with your digital modes transceiver(s) to convert your radio signals into bits and bytes, which are sent into the various digital radio networks via your internet connection.

Regular readers will remember that we reviewed the Heiltron DV4mini hotspot a while ago (April 2016 *PW*). My review of the DV4mini was positive but experience over a number of months suggests that they do take quite a bit of setting up for DMR, otherwise they can be quite unreliable on that mode (D-STAR and Fusion performance is very much better). How would the openSPOT compare?

What SharkRF Say About the openSPOT

The manufacturer's specification has the following to say:

- Supports DMR (Brandmeister, DMRplus), D-STAR (DCS, REF/DPlus, XRF/DExtra, XLX), System Fusion (FCS, YSFReflector) networks. More supported networks and features will be available with new firmware releases.
- Supports cross modem modes. Talk with your C4FM radio on DMR and with your DMR radio on System Fusion networks.
- Very easy to use, works without a computer. No additional hardware required, works out of the box. All accessories included.
- Web interface for configuration and monitoring.
- HTTP, UDP/TCP API support.
- Custom 2FSK/4FSK RF protocol support with TDMA.
- USB powered, low energy consumption, 20mW RF output on 70cm.
- Create your own private radio network using our open source server application.
- Runs fully embedded software written in pure C, running on an embedded real time operating system. No Linux, bulky Windows software or failing SD cards.

First Impressions

I had eagerly anticipated the arrival of the openSPOT. I was keen to see whether the unit would be superior on DMR, in terms of better outgoing signal reports, compared with the DV4mini. I was also very interested to explore the capability of the unit to allow the use of a DMR radio on the Fusion networks.

The openSPOT arrived, nicely packaged, complete with Ethernet cable to plug into your router (there's no WiFi option at the moment although SharkRF are rumoured to be working on it), a USB power supply and a small antenna. The openSPOT itself is very small but feels well built. There's no instruction manual provided. Instead, a card included with the package points you at the SharkRF website for setup instructions.

Actually, this proves to be very simple indeed. Connect the Ethernet port of the openSPOT into your internet router and then apply power to the unit, using the supplied USB cable and power supply.

Give it a minute or so to boot up

and then, using a computer, mobile phone or tablet connected to the same network, point an internet browser to the openSPOT:

http://openSPOT

With any luck you will be presented with a logon screen. If that doesn't happen, you may need to find out which IP address the OpenSPOT is using and connect to it that way. If you're an iOS or Android phone user, you could use the Fing application on your phone to determine the various devices connected to your network and find the IP address. Once you know that, you can try connecting to the openSPOT using http://<ipaddress you discovered>, for example **http://192.1.168.141**

That's probably the hardest bit done!

Assuming you can see the login page, enter the password (the default is openSPOT in lowercase).

Getting Started on DMR

Now the world is your oyster! Let's assume that you want to get going on DMR. The first thing you should do is to use the openSPOT's AutoCal procedure to make sure that the openSPOT and your DMR rig are on exactly the same frequency (this was the issue that many people had with the DV4Mini on DMR).

Go to the Connectors webpage on your browser and select DMR AutoCal. You'll be prompted to press the PTT on your rig while the openSPOT works out the optimum frequency pairing. Once it's completed, you can save your settings that will then be used in all DMR work. Note that if you use more than one DMR radio, you might need to change your AutoCal setting for each radio, if you find they are different (mine were).

Having done this you are all set to connect to the DMR networks. As you'll probably know, there are multiple DMR networks and, of course, there are different ways of connecting to them. The openSPOT contains some quite advanced functionality that bears a strong resemblance to DMR repeater setup but I found that keeping it simple worked very well.

The openSPOT readily allows connections to the Brandmeister, DMRplus and Phoenix (DMR-MARC) DMR networks. Let's connect to the Brandmeister network first of all. We'll take the easiest option to make signals appear on your radio. You'll need to set up your radio – maybe choose 436MHz, timeslot 2 and talkgroup 9. You can tweak all of this as you become more adventurous.

Then, from the openSPOT webpage,

The openSPOT can be configured from the browser on a mobile phone.

An internal view of the openSPOT.

select the Connectors page and select DMR/Homebrew/MMDVM. Make sure that the transmit and receive frequencies are set correctly, select Homebrew protocol, set the UK server (2342), enter your callsign and DMR ID and under Server password, enter passw1rd (if you use another server rather than the UK one, note that the password is usually passw0rd). Finally, under the 'Auto connect to ID' field, enter a Brandmeister talk group or reflector number such as 4400 (UK) or 4639 (USA), which should generate some traffic. Press Save and you'll be connected to that talkgroup and any traffic will be sent to your radio.

This was what I did to get started and, connected to the USA Nationwide talkgroup 4639, very quickly had some nice QSOs with stations on the West Coast of the US who seemed to be quite excited to work someone in the UK. Great fun! I was also able to determine that the variable audio quality of the DV4mini was a thing of the past.

To make things more flexible, change the 'Auto connect to ID' value to 0. Now, you can set up some contacts on your rig for the various talkgroups you might want to connect to (such as 4639, 4400). Add a contact too, to 4000. Then, once you've set the openSPOT's connector to Homebrew/MMDVM, all you need to connect to, say, reflector 4639, is go into Contacts on your radio, select 4639 and hit the PTT on your rig. You should hear the openSPOT announce that you are now connected to reflector 4639. Once you are finished operating on the reflector, select 4000 in your contacts list and you'll be disconnected.

Essentially, this is all you need to know to get going on the Brandmeister network. You can explore the various talkgroups and reflectors (if you want to see where the traffic is, go to **http://brandmeister.network** in your browser). You can even connect directly to someone else's openSPOT if you know their DMR ID. There's plenty more advanced things you can do with the openSPOT but this was enough to get me started.

Getting Started with DMR on the Phoenix Network

There are two main DMR networks in the UK – Brandmeister (largely in the North of England) and Phoenix (largely in the South of England). Until recently, it was not possible to connect to the Phoenix network from hotspots but, at the time of writing at least, that has changed. Here's how.

Change the connector to DMRplus dongle, check your transmit and receive frequencies – these should be correct. Now set the server to 'Phoenix-C' and enter your DMR ID and the reflector to 4400 UK Calling and hit Save.

After a few moments you should hear a 'connected' message. You should now hear any traffic from the UK Wide talkgroup (235) on the Phoenix network. If you establish contact on that talkgroup and intend to have a long QSO, you should connect to one of the chat talkgroups (Phoenix TG83 equates to DMRplus 4402 and TG84 to DMRplus 4403). You can, once again, disconnect using the contact you set up with talkgroup 4000 in it and setting up new contacts for talkgroups 4402 and 4403 will allow you to do all this from your radio rather than having to use the web

Front back and top views of the openSPOT.

interface. I found this worked well and enjoyed QSOs on the UK Wide Talkgroup on the Phoenix network, including working G4VXB in Faversham (G4VXB from G4VXE probably surprised a few listeners!).

You can use the same connector to connect to the DMRplus network. Just select a different master server and you will be able to use the DMRplus talkgroups. I didn't find this particularly useful because most of the traffic seemed to be either on the Brandmeister or Phoenix networks but your experience may vary.

Connecting to C4FM (System Fusion) Networks

The openSPOT allows you to connect to System Fusion networks. You cannot connect directly to the Yaesu Wires-X network but you can connect to either the FCS Fusion reflectors or the YSF reflectors. Virtually all of my testing was against the FCS system.

What makes openSPOT special in Fusion terms is that you can either use your Fusion radio – you may remember that *PW* reviewed a number of Fusion capable radios in 2016 – or you may use a DMR rig. I did not have a Fusion capable rig to hand so I took the DMR route. I was excited about this because I had made some very enjoyable contacts when I was reviewing the Fusion system last year and quite missed having the ability to connect to the FCS network.

Here's how to connect your DMR radio up to one of the Fusion networks. From the Connectors page, select the FCS connector. You should find that the transmit and receive frequency fields are set correctly. You can then select the Server and Room number you want to connect to. Some good ones to try are FCS001/55 (UK), FCS001/06 (USA), FCS001/54 (Net each Saturday from 2000-2200) and FCS003/90 (America Link Wires-X bridge) but there are plenty

of others to choose from too. Enter your callsign and your DMR ID (in the CCS7 ID field) and Save. Then hit 'Switch to Selected' underneath the Connector field.

At this stage you will be shown a message that warns you that the current modem setting doesn't match the selected connector and asks whether you would like to switch the modem to C4FM mode. If you are using a DMR radio, you can simply hit Ignore. Or, of course, if you're using a Fusion capable rig, you can change the Modem Mode.

A short time later, you should get a message to say that you are connected to the reflector and room that you selected. Unlike on a Fusion radio, you won't get the name and callsign of the station that's transmitting on your DMR radio's screen. However, if you are using a later beta version (95 onwards) of the openSPOT firmware, if you go to the Status page, you'll be able to see more information about the stations that are transmitting.

I found the option to use my DMR radio on Fusion worked really well. I had a number of very enjoyable QSOs, including working **Kev Mair 2M0KVM** who has done such a great job in encouraging activity on FCS001/54. There were one or two occasional wrinkles. Once, I was listening to some activity in one Fusion room and when one station was transmitting, I heard nothing, but those using Fusion rigs were able to hear him perfectly. Readers who recall the *PW* System Fusion articles may remember that there are two Fusion voice modes (DN – Data and low quality voice – and VW – High Quality voice). It turned out that the station I couldn't hear was transmitting VW mode and that the firmware was unable to decode that mode. That may well change with time. I didn't find it a major inconvenience and only encountered the issue once during a fairly extended review period. The other strange thing was that, occasionally, I would listen to a room and all stations seemed to have an echo on their transmission. It sounded like 20m long-path with the round-the-world echo! Discussing this effect with other stations, they confirmed this was not heard if you connected in C4FM mode so it was something to do with how the openSPOT in DMR mode and the server/room were interacting. The openSPOT team are investigating and no doubt a solution will be found in due course. Again, it was not a major problem and I only noticed it on two or three occasions.

In the interest of clarity, it's worth pointing out that what you can't do with the openSPOT is to use a cheap FM rig to connect to Fusion in analogue mode (remembering that Wires-X supports both C4FM and FM modes) – you can only use either a Fusion or DMR radio.

Connecting to D-STAR Networks with the openSPOT

I found that connecting to a D-STAR network with the openSPOT works well. It requires that you select the appropriate connector from the 'Connectors' page, using the web interface. There are two different connectors, depending on which of the networks you want to connect to. I mostly used the connector allowing access to the REF001C Worldwide reflector. This worked very well indeed and I enjoyed a number of contacts using my

Icom IC-E92 DSTAR handheld, including a nice chat with **Jon Wheeler G0IUE**. There is no option to use the D-STAR networks with anything other than a D-STAR radio. I also used the DCS005B reflector and made some good QSOs with that connector. There is also the option to connect to the very extensive list of XREF reflectors. It's so extensive that it can take quite a while to select the right one, especially if it appears towards the end of the list. Performance on D-STAR seemed at least as good as, if not slightly better than, with the DV4mini.

General Impressions and Firmware Upgrades

In many ways, I have only scratched the surface of what's possible using the openSPOT but, hopefully, you can see that it is very flexible in operation and is also very simple to set up. I particularly liked the way that I could access its web interface from anywhere on my local WiFi network, using a phone, tablet, laptop or PC. I used the web interface across a range of browsers, including Chrome, Internet Explorer and Safari, and encountered no problems.

RF-wise, by the way, the openSPOT can run up to 20mW on 70cm. Even with the supplied small antenna and the unit on the floor of the lounge close to the internet router, this was more than enough to cover the house and garden and, in fact, in practice I turned the RF output down a bit.

Although I didn't try any development against it, if you're a web developer or have an interest in that area, the openSPOT has an Application Programming Interface (API) that looks quite straightforward and interesting. I noticed some months ago a project where someone had taken the output of their WSJT-X program receiving JT65A or JT9 spots and fed it through their openSPOT to deliver text messages on their DMR radio around the house. That caught my imagination! I did play around with sending messages from the web interface on the openSPOT to my DMR handhelds. The situation is not entirely straightforward because different radios appear to have slightly different implementations of text messaging. It's interesting to play with, however, and could easily support a project or two.

The other thing worth mentioning is that there are frequent releases of the openSPOT firmware. There's a 'stable' firmware release and also a 'beta' firmware release. The beta releases happen frequently and allow you to try out new features. Clearly, there's a risk with this as anyone who works with software knows. You change some code, you introduce some bugs! But my experience with the 'beta' releases has been very positive and I've enjoyed getting my hands on new features sooner. Indeed, you may find some small differences in some of the items I've described in this review, depending on which firmware release you are using, but I've not described anything that is only available in the beta release chain. It's worth noting, too, that the support on the openSPOT support forums is excellent. The development team keep an eye on posts and very often chip in with suggestions on how to resolve issues.

Upgrading the firmware is a very simple process. I was rather nervous about attempting it on a piece of review equipment in case something went wrong but I really needn't have worried.

The process is this: you download the new firmware release to your computer and save it to a folder. Then, unplug the openSPOT USB cable from the power supply and connect it to a USB port on the computer where you saved the firmware file. Wait for the openSPOT to start up again and connect to the web interface. Go to the settings page and press the 'Reboot to bootloader' button. Wait for a little while and you should then see that a new 'disk drive' called Bootloader has appeared on your computer. All you need to do is to drag the firmware file that you downloaded into the new disk drive. Wait for a minute or two – the openSPOT's lights will flash vigorously and then calm down. Once they do, if you look on the folder where you copied the firmware file to, you should find a file called SUCCESS.TXT, indicating that the upgrade worked. If you leave the openSPOT for a minute or so, it will reboot automatically back to the normal mode.

You might find that, following an upgrade, you need to refresh your browser cache by hitting Shift-F5 in order to have correct operation of the openSPOT's web interface. Once you've seen it's come back up successfully, you can disconnect the USB cable from your computer and reconnect it to the original USB power supply.

It's actually easier to do the upgrade than to describe it. Once you've done it a couple of times, you'll feel confident about it and will look forward to the new facilities that often appear in a release.

Overall

I was very impressed indeed with the SharkRF openSPOT. It is a sophisticated device, easy enough to use for the comparative beginner to digital voice modes but with plenty of interest for the more advanced user too. It provides a more reliable service (albeit at a considerably greater cost) on DMR than the DV4mini and the ability to use Fusion networks from a DMR radio is a real winner for me. I particularly liked the ability to configure it using my mobile through a web browser from wherever I was in the house or garden. I should like to thank ML&S for the very kind loan of the unit. The SharkRF openSPOT costs £209.95 and is available from Martin Lynch and Sons.
www.hamradio.co.uk

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